CLAIMS

1. A fluorescence lifetime distribution image measurement device for measuring the distribution in a sample of the lifetimes of fluorescences emitted from said sample upon illumination of said sample with pulse excitation light, said fluorescence lifetime distribution image measurement device comprising:

a laser light source for emitting said pulse excitation light;

a measurement optical system for guiding said pulse excitation light emitted by said laser light source to said sample and thereby illuminating said sample, and guiding and outputting said fluorescences emitted from said sample;

a streak camera for recording the variations with time of the fluorescence intensities of said fluorescences that arrive upon being output from said measurement optical system; and

fluorescence lifetime distribution image creation means for calculating the fluorescence lifetimes based on said variations with time of the fluorescence intensities recorded by said streak camera and creating a fluorescence lifetime distribution image;

said measurement optical system comprising first scanning means, light separation means, second scanning means, and an objective optical system,

said first scanning means scanning said pulse excitation light, emitted by said laser light source, in a first direction,

said light separation means guiding said pulse excitation light, arriving from said first scanning means, to said second scanning means and guiding said fluorescences, arriving from the second scanning means, to said streak camera,

said second scanning means scanning said pulse excitation light, arriving from said light separation means, in a second direction perpendicular to said first direction and guiding said fluorescences, output and arriving from said objective optical system, to said light separation means so that said fluorescences pass through the same optical path that said pulse excitation light passed through in being directed from said light separation means to said second scanning means, and

said objective optical system converging and illuminating said pulse excitation light that has been scanned in said first direction and second direction respectively onto respective scanning points in said sample and outputs the fluorescences, which are emitted from said respective scanning points upon illumination of said pulse excitation light, to said second scanning means.

2. The fluorescence lifetime distribution image measurement device according to Claim 1, wherein

said objective optical system is positioned at a position at which the convergence points are set inside the sample; and

said pulse excitation light has a pulse width of no more than 150fs, a peak power density at said convergence point of no less than $1 \times 10^5 W/cm^2$, and a wavelength of no less than λ and no more than 2λ, where λ is the maximum wavelength of light that can excite said sample and cause fluorescence.

3. The fluorescence lifetime distribution image measurement device according to Claim 2, wherein

said pulse excitation light has a wavelength of no less than 750nm and no more than 1000nm.

4. The fluorescence lifetime distribution image measurement device according to Claim 2, wherein

the position of said objective optical system moves along a direction perpendicular to both the first direction and the second direction.

5. The fluorescence lifetime distribution image measurement device according to any of Claims 1 to 4, wherein

said first scanning means and second scanning means are respectively galvanomirrors, and said light separation means is a dichroic mirror.

6. A fluorescence lifetime distribution image measurement method for measuring the distribution in a sample of the lifetimes of fluorescences emitted from said sample upon illumination of said sample with pulse excitation light, said fluorescence lifetime distribution image measurement method comprising:

a first step of generating said pulse excitation light of a pulse width of no more than 150fs, a peak power density at the convergence point of no less than $1 \times 10^5 W/cm^2$, and a wavelength of no less than λ and no more than 2λ, where λ is the maximum wavelength of light that can excite the sample and cause fluorescence;

a second step of scanning said pulse excitation light in a first direction;

a third step of scanning said pulse excitation light, which has been scanned in said first direction, in a second direction perpendicular to said first direction;

a fourth step of converging and illuminating said pulse excitation light, which has been scanned in said first direction and second direction, respectively, onto respective scanning points inside said sample;

a fifth step of recording the variations with time of the fluorescence intensities of said fluorescences that are emitted from said respective

scanning points by the illumination of converged said pulse excitation light; and

a sixth step of calculating the fluorescence lifetimes based on said recorded variations with time of the fluorescence intensities, and creating a fluorescence lifetime distribution image.